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E1S
(71) Applicant
Acrow (Engineers) Limited,
8 South Wharf Road,
London,
W2 1PB
(72) Inventor
George Bernard Arthur Young
(74) Agents
Lloyd Wise, Tregear and Co.,
Norman House,
105—109 Strand,
London,
WC2R 0AE

(54) Formwork system

(57) A formwork system for supporting concrete (or other settable material) during setting which comprises a number of formwork panels 21 and a number of primary beams 12, which, in use, span horizontally between and are supported by standard vertically positioned props 10 or other vertically positioned members, each primary beam having a ledge 30 extending outwardly from both sides along the length of the beam, the distance from the top of the ledge to the top surface of the primary beam being the same as the depth of the formwork panels so that, in use, the panel may be supported on the ledges of two adjacent primary beams and span the distance between the beams with the top surface of the panels aligned with the top surface of the beams to produce an overall flat casting surface. A number of secondary beams can be used with this system, for example, each may have an overall depth in which the top surface of the heads of the props are, in use, aligned with the top surface of the beams and panels.

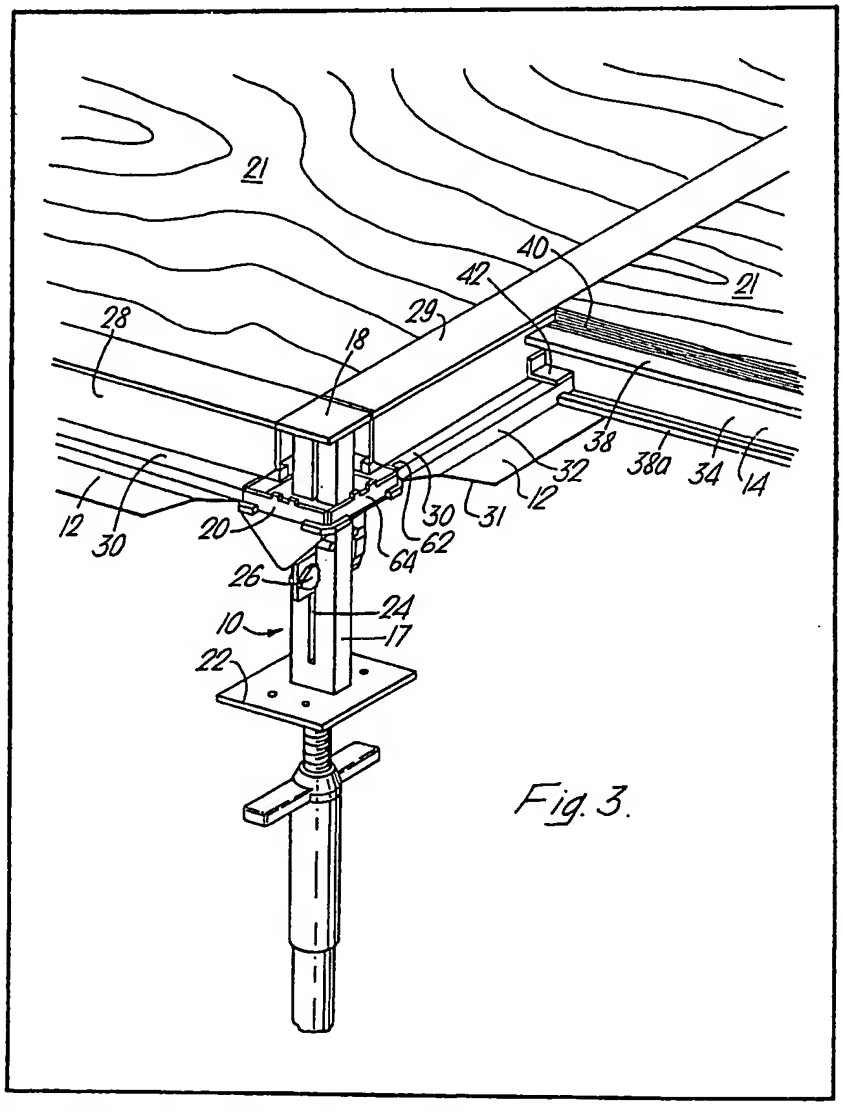

Fig. 3.

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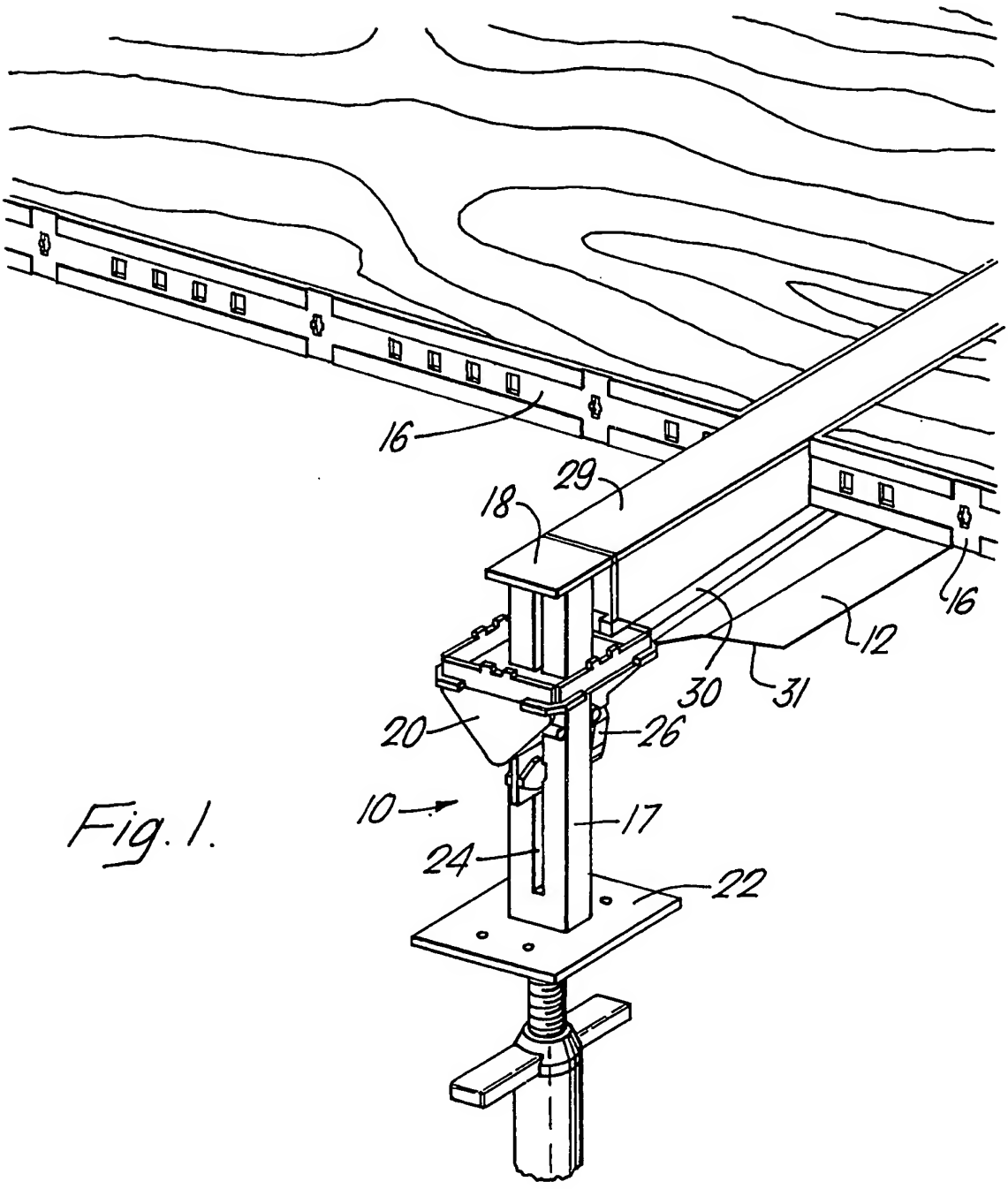


Fig. 1.

Fig. 2.

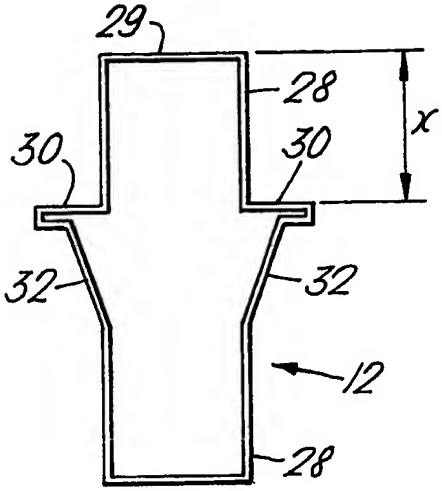


Fig. 4.

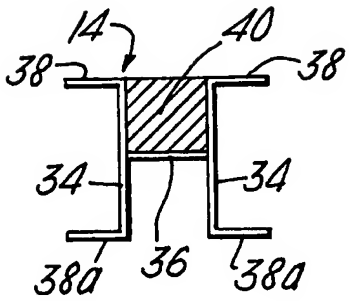


Fig. 5.

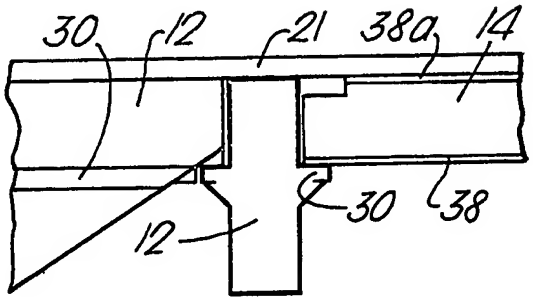
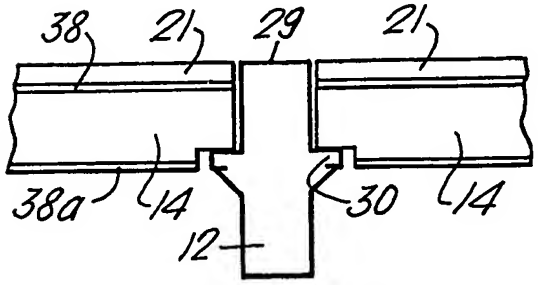


Fig. 6.



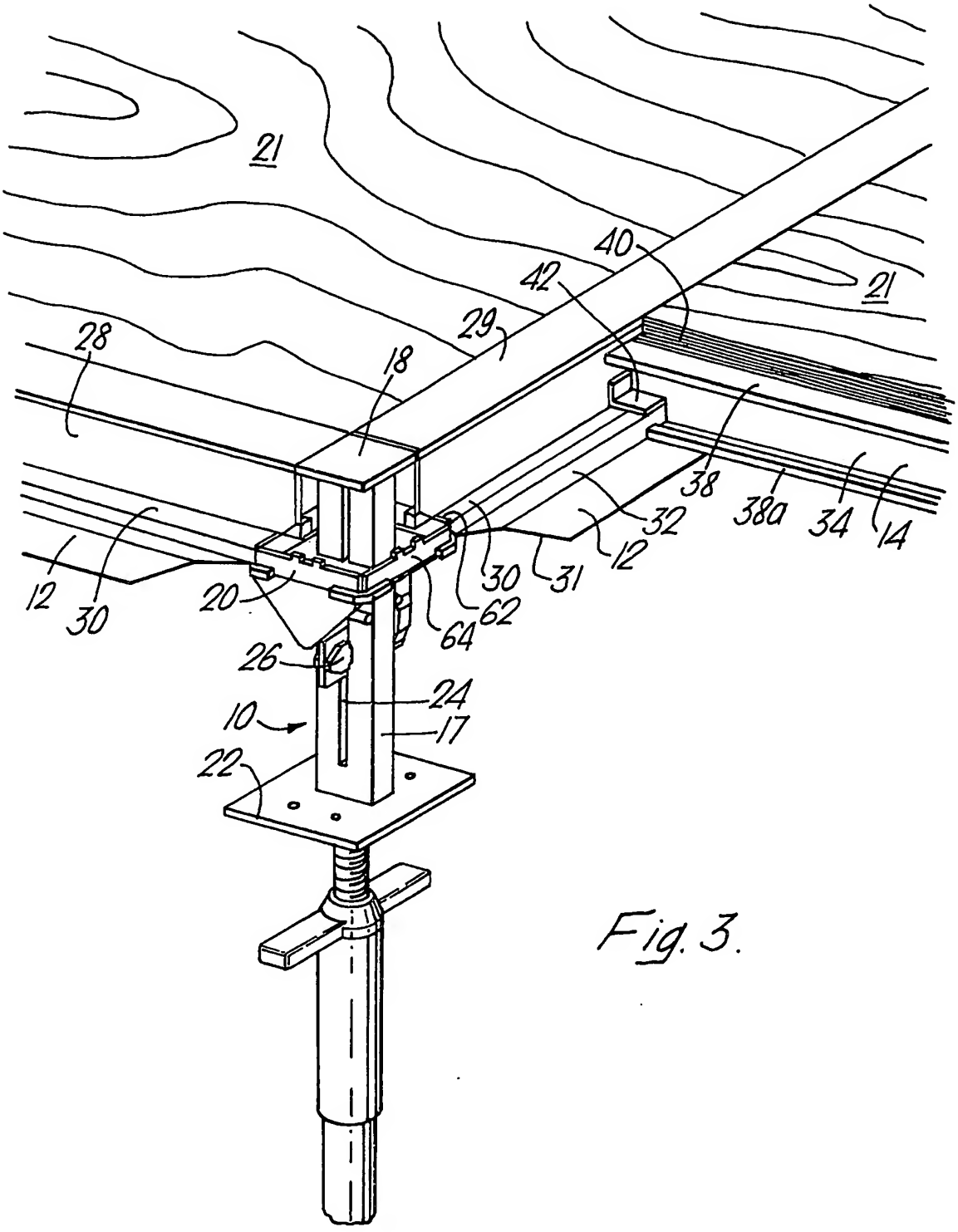

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Fig. 3.

Fig. 7.

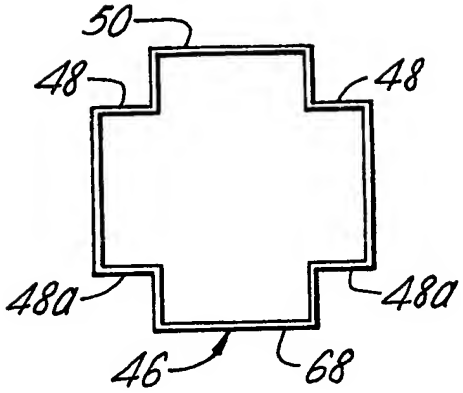
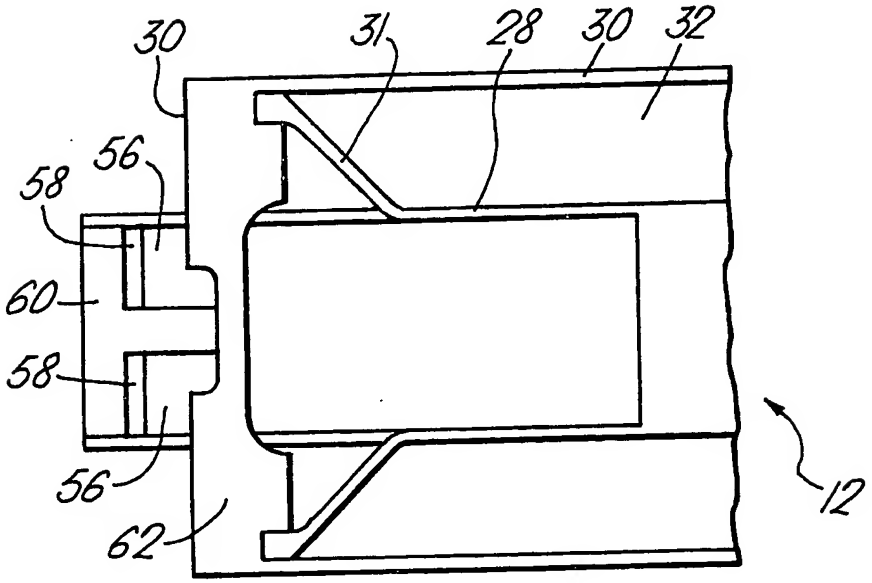


Fig. 9.



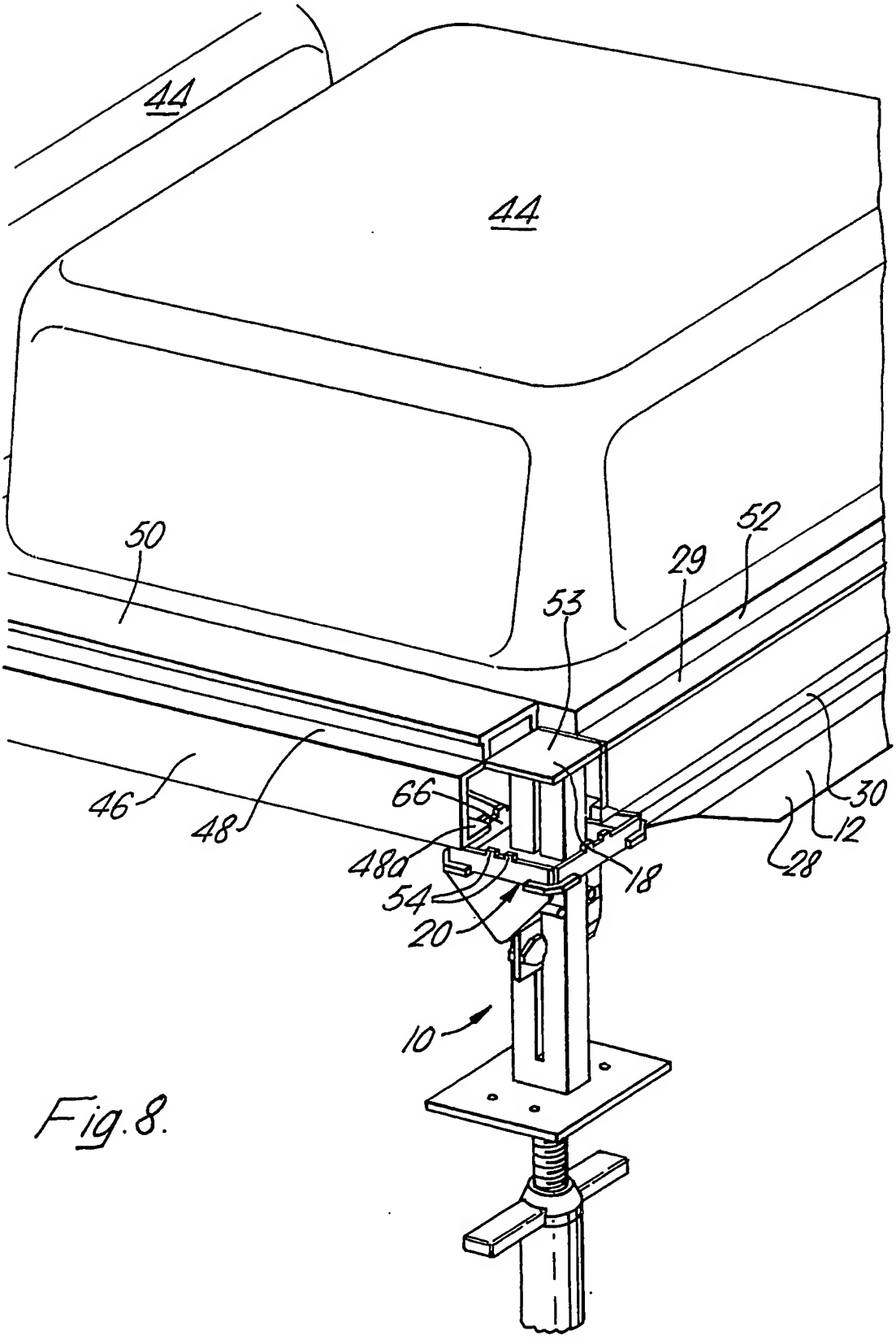


Fig. 8.

SPECIFICATION

Improv m nts in and r lating to c ncret f rmw rk systems

The invention relates to concrete formwork systems.

Formwork support is usually constructed to accomodate one type of deck unit such as panels, plywood sheets, or waffles and troughs (coffer moulds). It is, however, desirable to provide a formwork system which can accomodate a number of interchangeable deck units simply and safely.

A formwork system in accordance with the invention for supporting concrete (or other settable material) during setting, comprises a number of formwork panels and a number of primary beams which in use span horizontally between and are supported by, standard vertically positioned props or other scaffold members, each primary beam having a ledge extending outwardly from both sides along the length of the beam, the distance from the top of the ledge to the top surface of the primary beam being the same as the depth of the formwork panels so that in use a panel may be supported on the ledges of two adjacent beams and span the distance between the beams with the top surface of the panels aligned with the top surface of the beams to produce an overall flat casting surface.

If the top surface of the heads of the props are also aligned with the top surface of the beams and panels which is much to be preferred, then the beams and panels may be stripped from partially set concrete leaving the partially set slab supported by the props.

The system may also include secondary beams which have an overall depth which is equal to the distance between the top of the ledge and the top of the primary beam so that when in position resting on the ledges of two primary beams and spanning between the beams (or spanning between two support heads) a sheet of ply or the like may extend across several primary and secondary beams. This avoids having to cut ply sheets to size and reduces the necessity for ply filler strips.

The secondary beams preferably have the top or bottom surface of their ends cut away to form a shoulder which is spaced from the said top or bottom surface by a distance equal to the desired thickness of a ply (or other material) panel so that if the shoulder or the end of the secondary beams are supported by the ledges of primary beams enabling formwork plywood panels to be supported on the secondary beams between the primary beams and having an upper casting face which is flush with the t p of the primary beams.

In this latter case the sec ndary beams may be formed with a groove in its upper surface t receive a wood insert thus enabling the ply panel to be nailed to the secondary beams.

The syst m may include a number f waffle or trough moulds and a number of secondary beams designed to span between two primary beams (or between two support heads) and be supported on the ledges thereof, the height of the s condary beam from its end surface which is to be supported on a ledge of the primary beam, to the top surface of a support ledge being equal to the distance from the top of the ledge of a primary beam to its top surface, the said ledges running along each side of the secondary beam the distance between the top surface of the ledges and the top surface of the beam being equal to the thickness of the flanges of the waffle or trough moulds which in use are supported on the ledges of the secondary beams. In this way the bottom surface of a trough formed by and between the flanges of two adjacent moulds and by the top surface of the secondary beams supporting the said two flanges, is flat.

It will thus be seen that the formwork system of this invention is very versatile, easy to use and is relatively cheap.

The beams may be of extruded aluminium for lightness.

An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings in which:

Figure 1 is a perspective view of part of one embodiment of a formwork system according to the invention,

Figure 3 is perspective view of another embodiment of the formwork system according to the invention,

Figures 2, 4, 5, 6 and 7 are cross-sections of various forms of beams which may be incorporated in the system,

Figure 8 is a perspective view of another embodiment of the formwork system according to the invention; and

Figure 9 is an enlarged underneath view of one of the beams used in the invention.

Referring to Figure 1 the formwork system comprises three main components namely a drop head 10 of a vertical support, a primary support beam 12 and a number of casting or shuttering panels 16 in the form of panels having an extruded aluminium frame.

The drop-head 10 comprises a vertical support 17, an upper head 18, an intermediate support plate 20 and a lower plate 22. The intermediate support plate 20 is movable up and down a vertical slot 24 provided in the vertical element 17 between an upper and operative position and a lower and inoperative position, the plate 20 being held in the upper position by a cam wedge 26 which when released allows the intermediate plate 20 to drop slowly a small distance, and then to drop quickly a longer distance to the lower position. The operation and further features of the dr p-head are described more fully in our co-pending application no. 8117525.

Each primary support beam 12, shown in mor detail in Figure 2, is a hollow extrusion having a central upright body section 28 and two ledges 30 extending outwardly from the central section 28. These ledges 30 are provided underneath with supports 32 to give the ledges extra

strength. The beams 12 also have a flat top surface 29 and are tapered at each end 31 (see Figure 1). The distance x between the top surface 29 of the body and the top surface of the ledges 30 is predetermined as explained hereafter.

The primary beam 12 is shown in Figure 1 supported on the support plate 20 which is in the upper and operative position of the drop-head 10. The distance between the upper edge surface of the sides of the plate 20 when in this position, and the upper surface of the head 18 is equal to the distance x so that when the beam 12 is supported on the plate 20, the top surface 29 of the beam is flush with the upper surface of the head 18.

Furthermore the panels 16 which are supported on the ledges 30 and which extend across between two beams, are also of thickness x, so that the upper surface of the panels, the top surface 29 of the primary beams and the upper surface of the heads 18 of the props are all flush with each other, enabling a slab of concrete (or other settable material) to be cast thereover with a flat lower surface.

The upper surfaces 29 of the beams 12 and head 18 are also of equal width so that the sides of the panels 16 need no modification or alteration.

To strip the panels 16 from partially set concrete the wedge 26 is simply released and the plate 20, beams 12 and panels 16 drop down to the lower position leaving the upper head 18 of each prop to support the partially set concrete slab. The panels 16 and beams 12 are then removed from the plate 20 for use elsewhere.

The system may also include 'ply' secondary beams 14 (shown in detail in Figure 4) which have a generally H-shaped cross-section with two upright U-shaped channel side members 34 placed back-to-back and joined together by a cross member 36, the side members 38 and 38*a* of the channel providing support surfaces. The depth of the beam, i.e. the distance of the flanges 38 from the flanges 38*a* is also the distance *x* of the primary beams so that when beams 14 are positioned so as to extend at right angles to the primary beams and be supported either on ledges 30 of two adjacent primary beams or support plates 20 of two props (when in the upper position), the upper surface of the secondary beam 14 is flush with the upper head 18 and the primary beam top surface 29. A shuttering member in the form of a sheet of ply 21 may then be placed over the beams 12 and 14 and head 18, onto which the concrete is then cast (see Figure 5). The advantage of this system is that it avoids having to cut ply sheets to size and reduces the necessity for ply filler strips to have to be provided.

The ends of the secondary beams 14 are shaped (as shown in Figure 3) by cutting away th lower flanges 38*a* to form or allow for shoulders 42 spaced from the flanges 38*a* by a distance qual to the thickness of a ply (or other material) panel. Thus when the should rs 42 ar supported either on the ledges 30 or plates 20, a ply panel 21 may be placed on the upper flanges 38 of the beams 14 and the upper surface of the ply panel 21 will then be flush with top surface 29 and upper head 18 (see Figure 3). In this system standard sized plywood sheets are used, being supported by the beams 14 and located between the beams 12 and upper heads 18. This arrangement also avoids having to cut ply sheets to size and reduces the necessity for ply filler strips. The beams 14 are provided with wooden inserts 40 positioned between the side members 34 and cross member 36 so that the panels 21 when placed on the beam 14 can be securely fixed by nails passing through the panels and into the wooden inserts 40.

The beam 14 has the advantage that it can act to provide two different functions, i.e. that of supporting ply panels between the primary beams, or panels extending over all beams. This is as explained above because the beams can either be supported on flange 38 where this is positioned below flange 38*a* or on a shoulder 42 positioned above the flange 38*a*. These two functions have hitherto been carried out using different and separate secondary beams. This obviously leads to the use of only half the number of secondary beams which reduces cost and labour.

An alternative secondary beam is used when the formwork system is used to construct a "waffle" or "trough" deck. The waffle and trough secondary beam 46 (shown in detail in Figure 7) is of substantially cruciform section, four ledges 48 and 48*a*, being formed at the angles of the cross.

The dimensions of the beam 46 is such that the ledges 48 and 48*a* are spaced apart by the same distance 'x' described in relation to the primary beam. Thus if the ledges 48*a* are supported either by the plate 20 or ledges 30 of the beams 12 then the upper ledge 48 will be flush with the top surface 29 of the primary beam and upper head 18 of the prop.

Furthermore, the top surface 50 of the beam 46 is spaced from the ledges 48 by a dimension which is the same as the thickness of the waffle or trough mould flange 52 (see Figure 8) with which it is intended to be used. Accordingly, the upper surface of a flange 52 of waffle 44 or trough mould is flush with the top surface 50 of the beam 46 when the flange 52 is supported on ledges 48 and/or supported on the top surface 29 of the beam 12.

The surface of the 'trough' mould, which is formed between two protruding 'waffle' mould members 44 and by the upper surface of the two adjacent flanges 52 and the central part 50 of the secondary beam 46, is substantially flat.

In use the beams 46 span between and are supported by the ledges of the main or primary beams 12, or as shown in Figure 8 it may span between two props being supported by the drop plate 20.

The spaces above the upper head 18 of the

drop head will not be filled with either part of the waffle or beam 46. To fill these spaces 53 small plywood infill pieces corresponding in area to the upper head 18 and in thickness to the waffle are inserted.

The system thus provides primary beams 12 which may support ply secondary beams 14 so as to accommodate a ply sheet deck at one site, and subsequently at a different site the same primary beams 12 may support waffle secondary beams 46 so as to accommodate a waffle and/or trough deck. Advantageously this prevents the use of two different sets of primary beams, one set for ply sheets and another set for waffle and/or troughs, and leads to the use of half the number of primary beams previously used reducing cost and labour.

The formwork system may also use both secondary beams 14 and 46 at the same time to produce a floor or ceiling that is partly made from, for example, a waffle mould and partly made from concrete cast on plywood panels. An example of this combined use of the secondary beams 14 and 46 would be a car-park ceiling which was made of reinforced thick layers of concrete around the edges, while the centre portion was formed with waffle moulds.

The method of producing this type of ceiling would be to use secondary beams 14 to span the primary beams 12 around the edge of the ceiling and to cast a thick layer of concrete on the plywood panels supported by those beams 14. In the middle of the ceiling, secondary beams 46 would be used to span the primary beams 12 and support waffle moulds.

The primary and secondary beams are all provided with means at each end such that they can be positioned quickly and safely on the intermediate or drop support plate 20 of the drop head 10 or on the ledges 30 of the primary beam 12. The plate 20 is substantially square shaped, each side of the plate 20 being provided with two locating nibs 54 upstanding from the plate 20 (see co-pending Application No. 8117525). Each of the beams has means which cooperate with these nibs 54 to provide quick and accurate positioning of the beams.

In the primary beams 12 this means comprises a cast aluminium end shoe (see Figure 9) provided at each end of the beam 12. The shoe comprises two grooves 56 into which fit the nibs 54. The nibs are located by two sloping surfaces 58 between the grooves 56 and the rest of the shoe 60. The end 62 of each beam 12 when supported on the drop head 10 lies flush against the vertical side 64 of intermediate plate 20.

To detach the beam 12 from the nibs 54 all that is required is to lift the beam slightly so that the nibs are removed from the grooves 56 and the beam taken away from the plate 20. When a beam 12 is supported by another primary beam 12 the surface 60 of the shoe lies on the ledge 30 while the end 62 lies flush with the outer side of the ledge 30.

In the secondary beam 14 the means is simply two holes in the shoulder 42 which corresp nd in size and position to the nimbs 54 to give good location of the beam 14 when on the support plate 20. The beam 14 is supported on the ledges 30 of the beams 12 by either the shoulder 42 or flanges 38. In the secondary beam 46 the means is simply a cut away portion 66 of each end of the lower surface 68 of the beam 46 so that the ends of the ledges 48*a* may lie on the plate 20 and the nibs 54 lie between the ends of the two ledges 48*a* to locate the beam 46. This cut away portion 66 also allows each end of the ledges 48*a* to lie on the ledges 30 of the beam 12 when desired, as if there was no portion 66 the lower surface 68 would have to lie on the ledges 30 and this would not produce the flush surfaces required.

An example of the dimensions of the various components of the structure is that the distance x is 85 mm. Accordingly the depth of the ledges 30 from the top surface 29 of a beam 12 is 85 mm, the thickness of a beam 14 is 85 mm, the distance between the ledges 48 and 48a of a beam 46 is 85 mm and the thickness of aluminium panels is also 85 mm.

The beams 12, 14 and 46 are also preferably provided with upper surfaces corresponding in width to the upper head 18 of the drop-head 18 which for example may be 75 mm. Furthermore as a standard size thickness of plywood sheets is 19 mm then the distance of the shoulder 42 from the flanges 38a of a beam 14 is 19 mm, and as a standard size thickness of waffle or trough flange is 25 mm, then the distance of the top surface 50 from the ledges 48 of a beam 46 is also 25 mm. Finally the plywood infill pieces would be a size of 75x75x25 mm if these dimensions were used.

The primary beams 12, and the secondary beams 14 and 46 are preferably extruded aluminium section. The advantage of using the process to produce the beams is that the process reduces the time of manufacture and fabrication and the cost of production tooling and labour. The reason that the beams can be produced by extrusion is that the beams are substantially of simple and uniform cross-section throughout their lengths.

A system in accordance with the invention is especially useful in accommodating interruptions to standard modular arrangements such as columns, service cores and the like.

Claims

1. A formwork system for supporting concrete (or other settable material) during setting, comprising a number of formwork panels and a number of primary beams which, in use, span horizontally between and are supported by standard vertically positioned props or other vertically positi ned members, each primary beam having a ledge extending outwardly from both sides along the length of the beam, the distance from the top of the ledge to the top surface of the primary beam being the same as the depth of the formwork panels so that, in use, the panel may be supported on the ledges of two

adjacent primary beams and span the distance between the beams with the top surface of the panels aligned with the top surface of the beams to produce an overall flat casting surface.

2. A formwork system as claimed in Claim 1 in which the top surface of the heads of the props are, in use, aligned with the top surface of the beams and panels.

3. A formwork system as claimed in either Claim 1 or 2 including a number of secondary beams which have an overall depth which is equal to the said distance between the top of the ledge of the primary beams and the top surface thereof so that when in position, resting on the ledges of two primary beams and spanning between the beams a sheet of plywood or the like may extend across several primary and secondary beams.

4. A formwork system as claimed in Claim 3 in which the secondary beams have the top or bottom surface of their ends cut away and a shoulder is formed or produced spaced from the said top or bottom surface by a distance equal to the thickness of a panel to be supported by the said secondary beam when the top face of the panel will be flush with the top face of the primary beam.

5. A formwork system as claimed in Claim 4 in which the secondary beams are each formed with a groove in its upper surface to receive a wood insert to enable a ply panel to be nailed to the secondary beam.

6. A formwork system as claimed in any one of the preceding claims including a number of waffle or trough moulds and a number of waffle or trough secondary beams designed to span between two primary beams and be supported on the ledges thereof, the said waffle or trough beams being of cruciform cross-section, the height of the secondary beam from its end surface which is to be supported on the ledge of a primary beam to the top surface of the adjacent wall of the cruciform section being equal to the distance from the top ledge of the primary beam to the top surface thereof, the height of each protruding portion of the cruciform section being equal to the thickness of the flanges of the waffle or trough moulds so that the bottom surface of a trough formed by and between the flanges of two adjacent moulds supported by the said waffle or trough secondary beams and by the top surface of the secondary beams supported the said two flanges is flat.

7. A formwork system for supporting concrete (or other settable material) during setting on a casting surface, comprising a plurality of primary beams which in use span horizontally between and are supported by standard vertically p sitioned props or other scaffold members, a plurality of 'ply' sec ndary beams to support ply sheets, and a plurality of 'waffle' secondary beams designed to supp rt waffle and/or trough members, wh rein the 'ply' secondary beams and 'waffle' secondary beams are designed to be supported by and alternatively used, with the primary beams, the arrangement being such that, in use, the top surfaces of the primary beams, 'ply' secondary beams and/or 'waffle' secondary beams form part of either the casting surface or a flat support surface to receive panels whose top surface forms the casting surface.

8. A formwork system as claimed in Claim 7 wherein each primary beam has a ledge extending outwardly from both sides along the length of the beam, on which casting panels, ply secondary beams or waffle secondary beams may be supported.

9. A formwork system as claimed in either of Claims 7 or 8 wherein casting panels, ply secondary beams or waffle secondary beams are supported by standard vertically positioned props or other scaffold members.

10. A formwork system as claimed in any one of Claims 7 to 9 wherein the height of the top surface of the ply secondary beams relative to the primary beams is adjusted by inverting the secondary beams.

11. A formwork system as claimed in any one of Claims 7 to 10 wherein the top surface of the ply secondary beams and primary beams support the casting panels.

12. A formwork system as claimed in any one of Claims 7 to 11 wherein the top surface of the ply secondary beams supports the casting panels and the top surface of the primary beams form part of the casting surface.

13. A formwork system as claimed in any one of Claims 7 to 12 wherein the ply secondary beams have wooden inserts thus enabling the casting panels to be attached to the beams.

14. A formwork system as claimed in any one of Claims 7 to 10 wherein each waffle secondary beam has a ledge extending outwardly from both sides along the length of the beam, on which the casting panels may be supported.

15. A formwork system as claimed in any one of Claims 7 to 10 and 14 wherein the top surface of the waffle secondary beams form part of the casting surface and the top surface of the primary beams supports the casting panels.

16. A primary beam for a formwork system substantially as hereinbefore described with reference to Figures 1 to 3 of the accompanying drawings.

17. A secondary beam for a formwork system substantially as hereinbefore described with reference to either Figures 3, 4, 5 and 6 or Figures 7 and 8 of th accompanying drawings.

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